Modifications to the Imputation Routine for Health Insurance in the CPS ASEC: Description and Evaluation

September 2011

Authors:
Michel Boudreaux and Joanna Turner

Report to:

U.S. Census Bureau

www.census.gov

Prepared by:

shadac
State Health Access Data Assistance Center

www.shadac.org

Acknowledgements: We are grateful to Michael Davern and Shamis Mohamoud of NORC at the University of Chicago and to Peter Graven and Kathleen Call at SHADAC for their comments and analytical support. Brett O'Hara, Charles Nelson, and analysts at the U.S. Census Bureau provided excellent guidance and data support.

Table of Contents

Introduction

The Annual Social and Economic Supplement to the Current Population Survey (CPS ASEC) is an important source of information about health insurance coverage in the U.S. Due to its long time series, its state representative sample and its detailed series on health insurance the CPS ASEC is a critical data source for federal and state policy making and health policy research (Blewett et al., 2004). It is routinely used in surveillance activities and in policy evaluations; to project the cost of proposed legislation; and was historically used as an input in the federal allocation formula of the State Children's Health Insurance Program (SCHIP).

The U.S. Census Bureau is engaged in an on-going effort to improve the quality of health insurance information in the CPS ASEC (Ziegenfuss and Davern, 2011). The purpose of this paper is to explain the latest development in their quality improvement effort – a change to the imputation routine for health insurance coverage. In an experimental version of the 2009 CPS ASEC, the change to the imputation routine and a simultaneous correction to the coding of directly purchased coverage increased the percent of people with health insurance coverage by about 0.5 percentage points (1.5 million people), primarily through an increase in private coverage. The Census Bureau implemented the new method with the 2011 CPS ASEC and retroactively applied the new routine for the 2000 to 2010 CPS ASECs. In addition to the new allocation procedures, the new data files reflect all data processing adjustments that have occurred since 2000 (see below for details). The data were released as supplementary files available from the Census Bureau's health insurance web page.[1]

The rest of this paper is organized as follows. First, we describe the CPS ASEC, review its imputation procedures and discuss previous work that identified problems with the way health insurance was imputed. Next, we describe the modifications that the Census Bureau made to correct the problem. Finally, we empirically evaluate the new procedure and discuss the implications of our findings.

Background

The CPS is a monthly labor force survey conducted by the Census Bureau on behalf of the Bureau of Labor Statistics. The ASEC supplement is administered in February through April and asks additional questions on work, income, migration, and health insurance coverage. The CPS ASEC is based on a complex area probability sample and is representative of the civilian non-institutionalized population of the United States. About 100,000 addresses are sampled each year. In 2008, this was about 76,200 households.

Questions on health insurance coverage have been asked in a consistent manner since 1988. The instrument gathers information on the presence, type, and characteristics of coverage held during the previous calendar year. Information is obtained for each member of the household.

[1] Available at http://www.census.gov/hhes/www/hlthins/index.html. These new data will also be available from SHADAC's Data Center, http://www.shadac.org/datacenter, and the Minnesota Population Center's Integrated Public Use Microdata Series (IPUMS), http://cps.ipums.org/cps.

Over time improvements have been made to the instrument and data processing regimen. These improvements were undertaken with the desire to improve the accuracy of the instrument while maintaining, to the extent possible, the consistency of the time series (Davern et al., 2003; SHADAC, 2009; Ziegenfuss and Davern, 2011). In addition to the new allocation routine described in this paper, there have been 3 data processing changes since 2000 that will be included in the new supplementary files. These changes include a 2010 modification to assign Medicaid coverage to uninsured foster children, a 2005-2006 adjustment to the assignment of private coverage, and a 2002 correction to the assignment of SCHIP to a public coverage source. In 2006, a revised time series was released for 1997 to 2004 with an approximation for the 2005-2006 edit change. The series released in 2011 supplants the revised time series for 2000 to 2010.

Missing Data Allocation in the CPS ASEC

Similar to its other data products, the Census Bureau fills in all missing data in the CPS ASEC using allocation methods. This allows data users to use complete case methods without additional processing. Missing health insurance data includes all items for the roughly 10% of the monthly sample that does not fully complete the ASEC (called full supplement imputations) and the 2-3% of cases that respond to a large portion of the ASEC, but not to one or more health insurance items.

Missing values for each item in the health insurance series are filled in with hot deck allocation. Hot deck matches cases with missing data ("recipients") to a set of similar cases ("donors") that have a non-missing value on the variable of interest. The cases are organized into matrices and matched on characteristics, such as marital status and age, which are known to be predictive of health insurance coverage. Missing values are filled in by randomly selecting a valid value from the donors. Hot deck allocation may produce different means and variances than the complete cases. However, when correctly specified, the imputed data set should have the same correlation structures as the complete data. For more background on hot deck allocation see Davern et al., 2007; Andridge et al., 2010; and David et al., 1986.

Davern et al. (2007) observed that the instrument itself allowed any member of a household to be covered as a dependent on the policy of another household member. Indeed, interviewers can press a single key to automatically assign everyone in the household to the same plan. However, the imputation routine only allowed the nuclear family of a policy holder to be covered as a dependent. The authors hypothesized that this feature led to an underestimate of private coverage and an overestimate of uninsured, relative to expectations from the instrument itself.

To test their hypothesis they conducted two analyses. First, they used multinomial logistic regression to study the impact of full supplement imputation status on the presence and type of health insurance, controlling for variables that were included in the hot deck and other informative predictors. They argued that after controlling for covariates, full supplement imputation status would not be a significant predictor of insurance if the hot deck was correctly specified. However, they found that it was a strong and significant variable in their model. They concluded that their finding was due to the incongruence of the allocation routine and the survey instrument. In their second set of analyses they produced two counterfactual estimates of health insurance assuming that the data had no full supplement imputations. The first estimate removed all full supplement imputation cases and re-weighted the data to population

controls. The second set of estimates used the regression estimates to predict insurance coverage, assuming no full supplement imputations. Under both methods the alternative estimates produced a private coverage rate among the non-elderly that was one percentage point higher, no change to public coverage, and a one percentage point reduction in the uninsured.

Changes to the Health Insurance Allocation Scheme

In response to Davern et al. (2007), the Social, Economic and Housing Statistics Division at the Census Bureau reformulated the health insurance allocation specification. Table 1 describes the variables used in the hot deck and the modifications that were made. The change included several new features. First, the order of the data processing steps was changed. Public coverage was moved to be allocated first with un-imputed private coverage in the hot deck matrix. Following the imputation of public coverage, the public coverage consistency edit is run. This edit forces public coverage responses to be consistent with other information obtained in the survey.[2] Finally, the private coverage allocation routine is run with the nuclear family restriction removed from the rules governing the assignment of dependent coverage. This final change forces the allocation routine to mirror the instrument itself, which allows any household member to be a dependent on another household member's plan. The nuclear family restriction that was in place in the original imputation specification is conceptually appealing as it was consistent with health insurance coverage eligibility rules. However, the goal of imputation is not to logically edit the data, but to reproduce the distributions found in the reported data.

In the process of implementing these changes the Census Bureau also discovered and corrected a coding error that caused an undercount of direct purchase coverage for children. The allocation change and coding correction occurred simultaneously, so all estimates presented in this paper reflect the effect of both.

As discussed above, the 2011 CPS ASEC data release reflects these changes. The Census Bureau retroactively applied the new method and all other data processing adjustments made since 2000 to previous years of data. Data for the 2000-2010 CPS ASECs were re-released and can be obtained from the Census Bureau's health insurance web page.

Evaluation Strategy

We evaluated the new routine using a 2009 CPS ASEC research file that was delivered to the State Health Access Data Assistance Center (SHADAC). The file contained each variable that changed as a result of the new imputation. We merged the research file onto an original 2009 CPS ASEC public use data file and data from the SHADAC-Enhanced CPS (described below) to create an analytic data set. The analytic data, which we call the 2009 CPS ASEC research file, consists of all 207,921 cases from 2009.

Our strategy was two-fold. First, we used *t* tests to compare coverage rates from 3 sources: data produced by the old routine, the new routine, and data from the SHADAC-Enhanced CPS. Our *t* test formula

[2] For more information on the consistency edit see http://www.census.gov/hhes/www/hlthins/publications/coverage_edits_final.pdf.

accounted for the fact that both processing routines were run on the same sample. We adapted a standard error of the difference formula found in Census Bureau documentation (Expression 17, U.S. Census Bureau, 2010a). The formula should be used when differencing "two nonoverlapping averages." We set the correlation factor *r* equal to 0.99, the proportion of cases that had the same insurance values under both routines. This factor was the same for tests that compare the new routine and SHADAC-Enhanced CPS data.

Data from the old routine reflects the production environment in 2009. Data from the new routine, incorporating both the imputation modification and the coding fix, reflects the 2011 production environment. The SHADAC-Enhanced CPS data are created by removing the full supplement imputations and reweighting the remaining cases back to population totals (Ziegenfuss and Davern, 2011). This series was created to account for historical methodological changes and to correct for the bias in the imputation of health insurance status identified by Davern et al. (2007). The SHADAC-Enhanced CPS for 2007-2008 produced estimates that differ from the original CPS in the range of no change in Idaho to a 2.2 percentage point reduction in uninsured in New Jersey (SHADAC, 2010). While the SHADAC-Enhanced CPS series is not a gold-standard, we feel it provides a close approximation to what we expect from the new routine –an allocation that maintains the correlations between reported variables.

The second stage of our analysis was to estimate multinomial logistic models similar to that reported in Davern et al. (2007). We regressed a hierarchical coverage variable with three levels (defined as only private, public coverage alone or in combination, or uninsured) on an indicator of full supplement imputation status and covariates found in the hot deck specification. We ran the model on health insurance variables produced under the old routine and then on data produced by the new routine. A reduction in the size of the coefficient on full supplement imputation in the second model provides evidence of improvement.

Our model specification differed in important ways from the Davern et al. model. Namely, we estimated the model on all age groups, we did not include other potentially informative predictors not found in the hot deck, and we did not interact any terms.[3]

We coded all variables using standard Census Bureau definitions. Public coverage includes Medicare, Medicaid, the Children's Health Insurance Program (CHIP), other public programs, and military coverage. Private coverage refers to coverage obtained from an employer or union (ESI), coverage purchased directly, or coverage purchased by a person outside of the household. All coverage measures refer to any coverage in the preceding calendar year (2008). Unless otherwise noted (i.e. "private only") people can be classified as having multiple coverage types (i.e. alone or in combination). Covariates were coded according to the Census Bureau's coding specification with one exception. In place of work status of the spouse we created a variable that counts the number of family members that worked in the previous year. This was to account for the fact that a large share of the sample does not have a spouse, yet the employment status of the family reference person and their spouse is reflected in the imputation routine for each person in the data (see Table 1 for more details). We estimated standard errors that account for

[3] In a specification test we repeated our models on data from the old routine using Davern's exact specification and achieved nearly identical results as those reported in their 2007 paper. That model included: full supplement imputation status, family size, age, full supplement imputation*family size (1 person), full supplement imputation*age (0-18), gender, health status, race, ratio of family income to the poverty level, marital status, education, veteran status, and employer size.

the complex design of the CPS ASEC sample using successive difference replication (SDR) (U.S. Census Bureau, 2010b). SDR is the best available approximation of the true variance value. We considered differences that meet the $p < 0.05$ standard to be statistically significant, but also report results for $p<0.01$ and $p<0.001$.

Results

The top panel of Table 2 compares coverage rates for all age groups. Compared to the old routine, data derived from the new data processing routine reduced the uninsurance rate by 0.5 percentage points or 1.5 million people, a statistically significant result. The difference in the rates of any private coverage was also statistically significant across routines. It increased by 0.5 percentage points or 1.2 million people. A similar pattern was found for only private coverage. A large portion of the gain appeared to be driven by direct purchase coverage – 1.7 million additional people had direct purchase coverage. It is likely that the direct purchase coding correction had a large effect. The remaining differences in the rates of coverage between the new and old routine shown in the top panel of Table 2 were not significant.

As we expected, overall estimates of coverage for all age groups produced by the new routine closely tracked estimates from the SHADAC-Enhanced CPS. The one exception to this trend was the estimate of direct purchase coverage which was one percentage point higher in the new data compared to the SHADAC-Enhanced CPS data. A potential explanation of this finding is that the SHADAC-Enhanced CPS is based on data generated by the old coding structure which undercounted direct purchase relative to the new coding.

The remaining panels of Table 2 report coverage rates by age. Non-elderly adults were the most sensitive to the change. The new data produced a 0.6 percentage point gain or 1.2 million additional people covered, compared to the old routine. The next largest effect was for children and the smallest effect was found in elderly adults. The pattern of effect sizes by age reflects the distribution of private coverage—the main target of the imputation change and coding correction. Non-elderly adults were the most likely to be covered by private insurance, and elderly adults were the least likely. A final observation from Table 2 is that changes to specific coverage types do not have a one to one correspondence with a reduction in the count of the uninsured. This is due to people that are coded as having multiple coverage types.

We examined private coverage more closely in Table 3 because the changes to the imputation and the coding correction were focused on private sources of coverage. The top panel considers policy holder and dependent status for all age groups. The difference in rates between the new and old routine was not statistically significant for private policy holders or private dependents. However, the differences were substantially larger for dependents. This pattern of results is consistent with our expectations.

The largest significant difference between the new and old routine was for direct purchase dependents (0.4 percentage point increase). As described above, a large portion of this effect may be caused by the coding correction. While the change in the employer sponsored (ESI) dependent rate was smaller than the direct purchase effect and not a statistically significant result, the change in the number of people was large relative to the change of ESI policy holders. For example, across all age groups the gain to ESI dependents was 650,000 versus a decline of 58,000 for policy holders.

Compared to the SHADAC-Enhanced CPS, the overall private dependent rate from the new routine was 0.68 percentage points higher, a statistically significant result. Contrary to our expectations, the rate of ESI dependents was 0.43 percentage points (or 1.2 million people) higher in the new routine compared to the SHADAC-Enhanced CPS estimates. However, the statistically significant larger rates of direct purchase policy holders and dependents were expected. As described above, the SHADAC-Enhanced CPS is based on the old direct purchase coding scheme which undercounted coverage levels.

The next set of tables describes results from our regression analyses. These regressions determine if the problems with the full supplement imputation cases identified by Davern et al. (2007) are as strong in data produced by the new routine. Specifically, we determined if an indicator of full supplement imputation status is as influential a predictor of hierarchical coverage in the new routine as in the old routine, controlling for variables contained in the hot deck.

Table 4 describes the distribution of coverage status and hot deck covariates across full supplement imputation status. Full supplement imputation cases made up 9.1% of the sample (unweighted). In the new routine, full supplement imputation cases were less likely to be privately covered (52.7% vs. 56.5%; $p<0.001$) and more likely to be uninsured (18.3% vs. 14.5%; $p<0.001$) than those that completed the supplement. Consistent with our expectations, the magnitude of the differences in insurance rates was different in the old routine. The difference in the rate of uninsurance across imputation status was 3.8 percentage points in the new routine and 8.0 points in the old routine. This difference-in-difference of -4.2 percentage points was statistically significant. The difference-in-difference for only private coverage was -4.0 percentage points and statistically significant. There was no evidence of a significant difference-in-difference for any public coverage.

Table 4 also shows that full supplement imputation cases were also more likely to be non-elderly adults, more likely to be working, more likely to be on public assistance, and less likely to be veterans. Full supplement imputation cases may have a different coverage profile because of other confounding factors related to full supplement imputation status.

Table 5 presents results from our multinomial logistic regression models. All models use private coverage as the base category. We present exponentiated results and interpret them as relative rate ratios. In both models the Adjusted Wald test for the full supplement imputation coefficients was significant indicating that model results are not sensitive to the choice of the base category. The first set of columns describes results from the old imputation routine (Model 1). Controlling for variables in the hot deck, full supplement imputation cases were 1.8 times more likely to be uninsured relative to private coverage, compared to those that fully completed the ASEC. The ratio of public to private coverage was 1.3 times higher for full supplement imputations than for others. These are the baseline levels that the change in the imputation routine was intended to correct. Based on Davern et al.'s 2007 study we expected that the exponentiated coefficient on full supplement imputation status would move towards 1 in the new imputation. Such a finding would indicate that full supplement imputation status is a weaker independent predictor of health insurance coverage in the new routine.

The second set of columns describes the results from the new imputation routine (Model 2). Under the new routine, full supplement imputation cases were 1.3 times more likely to be uninsured relative to private coverage, compared to cases that fully completed the ASEC. They were 1.2 times more likely to

have public coverage relative to private coverage. These results demonstrate that in the new routine, full supplement imputation is a weaker, albeit still significant, predictor of insurance coverage.[4]

Discussion

In response to previous work that found an inconsistency between the instrument and the imputation routine for health insurance coverage in the CPS ASEC, the Census Bureau improved its imputation procedures. The bulk of the change was removing a restriction that limited dependent coverage to a policy holder's nuclear family. This restriction did not align with the instrument itself which allows dependent coverage to be applied to anyone in the household. In the process of making this adjustment the Census Bureau also found a coding error to direct purchase coverage.

Our analysis showed that these data processing changes led to a decrease in uninsurance by 1.5 million people. Coverage gains occurred mainly for private coverage. This finding matches our expectations from Davern et al.'s 2007 analysis and estimates produced from the SHADAC-Enhanced CPS.

We observed that data from the new routine tracked closely with estimates from the SHADAC-Enhanced CPS. There were two important exceptions. First, levels of direct purchase coverage were significantly higher in the new routine than they were in the SHADAC-Enhanced CPS data. It is likely that a large portion came from the direct purchase coding mistake. This suggests that the SHADAC-Enhanced CPS will need to be adjusted to account for the new coding scheme. This process will be facilitated by the Census Bureau's retroactive release of previous data years produced under the corrected production environment. The second exception was that the new routine produced significantly higher levels of ESI dependent coverage than found in the SHADAC-Enhanced CPS data. This finding is in need of further investigation.

Our regression analysis demonstrated that full supplement imputation status is a weaker predictor of coverage status in the new routine than in the old routine. This finding suggests that the new routine improves on the old routine, i.e., it does a better job of reproducing the correlations found in the reported data. However, the coefficient on full supplement imputation status was still positive and significant in Model 2 (new routine). This could be because the Census Bureau is limited in what it can include in the hot deck by sample size. For example, variables such as race, poverty, and state of residence are theoretically appropriate, but their inclusion would create matrix cells that are too small to sample (cf. Davern et al., 2004).

The changes described in this paper improve the quality of the CPS ASEC health insurance data. The new imputation routine and the correction to the direct purchase coding error were reflected in the 2011 data release. Data for survey years 2000-2010 were retroactively released in supplemental files available through the Census Bureau's health insurance web page. These new data reflect not only changes made in 2011, but all data processing improvement implemented since 2000. The retroactive release ensures a

[4] To confirm that the difference in coefficients from Model 2 versus Model 1 was statistically significant we ran a separate model in which data from the new routine was stacked on top of data from the old routine. The alternative model included the same covariate set. The independent variable of interest was an interaction of full supplement imputation and an indicator of the data processing version. We found that the marginal effects produced by this model were significant at the $p<0.001$ level. These results are available upon request.

consistent time series in the CPS ASEC health insurance variables from 2000 to the present. Users that wish to examine earlier trends can turn to the SHADAC Enhanced CPS which harmonizes previous methodological changes such as the introduction of the health insurance verification question.

References

Andridge, R.R. and R.J.A. Little. 2010. "A Review of Hot Deck Imputation for Survey Non-response." *International Statistical Review,* Vol. 78, Issue 1, pp. 40-64.

Blewett, L. A., M. B. Good, K. T. Call, and M. Davern. 2004. "Monitoring the Uninsured: A State Policy Perspective." *Journal of Health Politics, Policy and Law* 29 (1): 107–45.

Davern, M., T.J. Beebe, L.A. Blewett, and K.T. Call. 2003. "Recent Changes to the Current Population Survey: Sample Expansion, Health Insurance Verification, and State Health Insurance Coverage Estimates." *Public Opinion Quarterly* 67 (4): 603-626.

Davern, M. L.A. Blewett, B. Bershadsky, N. Arnold. 2004. "Missing the Mark? Imputation Bias in the Current Population Survey's State Income and Health Insurance Coverage Estimates." *Journal of Official Statistics* 20(3): 519-549.

Davern, M., H. Rodin, L.A. Blewett, and K.T. Call. 2007. "Are the Current Population Survey Uninsurance Estimates Too High? An Examination of the Imputation Process." *Health Services Research,* 42(5): 2038- 55.

David, M., R.J.A. Little, M.E. Samuhel, and R.K. Triest. 1986. "Alternative Methods for CPS Income Imputation." *Journal of the American Statistical Association,* Vol. 81, No. 393, pp. 29-41.

State Health Access Data Assistance Center. 2005. "Reclassifying Health Insurance Coverage for the Indian Health Service in the Current Population Survey: Impact on State Uninsurance Estimates." Issue Brief #11. Minneapolis, MN: University of Minnesota. Available at: http://www.shadac.org/files/IssueBrief11.pdf.

State Health Access Data Assistance Center. 2009. "Historical Changes in Current Population Survey Health Insurance Coverage Items for Survey Years 1988 through 2008." Issue Brief #19. Minneapolis, MN: University of Minnesota. Available at: http://www.shadac.org/files/shadac/publications/IssueBrief19.pdf.

State Health Access Data Assistance Center. 2010. "Comparing State Uninsurance Estimates: SHADAC-Enhanced CPS and CPS." Issue Brief #21. Minneapolis, MN: University of Minnesota. Available at: http://www.shadac.org/files/shadac/publications/IssueBrief21.pdf.

U.S. Census Bureau. 2010a. "Source and Accuracy of Estimates for *Income, Poverty, and Health Insurance Coverage in the United States: 2009.*" Available at: http://www.census.gov/hhes/www/p60_238sa.pdf.

U.S. Census Bureau. 2010b. “Estimating ASEC Variances with Replicate Weights.” Available at: http://smpbff2.dsd.census.gov/pub/cps/march/Use_of_the_Public_Use_Replicate_Weight_File_final_PR_2010.doc.

Ziegenfuss, J and M. Davern. 2011. “Twenty Years of Coverage: An Enhanced Current Population Survey—1989-2008.” *Health Services Research* 46(1 Pt 1): 199-209.

Table 1. Changes to the Health Insurance Coverage Allocation Routine, CPS ASEC

Construct (Variable Name)	Original Donor Matrix	Modification
Policy Holder of Group Health Insurance (HI)	For Workers: Age, Family Relationship, Class of Worker, Earnings Level, Firm Size For Non-workers: Age, Government Health Insurance, Family Relationship	Private imputation occurs after public imputation and public coverage consistency edit.
Group Health Insurance Type : Single or Family (HITYP)	Family Relationship, Presence of Children, Marital Status	Occurs after public imputation and public coverage consistency edit.
Dependent on Group Health Insurance (DEPHI)	There is no matrix. Dependent coverage is assigned to records that are not already dependents on a plan, are not policy holders themselves, and live in a family with a person that holds a family group health insurance plan policy.	Change family restriction to anyone in the household.
Policy holder of Directly Purchased plan (PRIV)	Age, Group Health Insurance, Family Relationship, Work Disability, Public Assistance or SSI	Private imputation occurs after public imputation and public coverage consistency edit.
Directly Purchased Plan Type: Single or Family (PRIVTYPE)	Age, Government Coverage, Family Relationship	Occurs after public imputation and public coverage consistency edit.
Dependent on Directly Purchased Plan (DEPRIV)	There is no matrix. Dependent coverage is assigned to records that are not already dependents on a plan, are not policy holders themselves, and live in a family with a person that holds a family group health insurance plan policy.	Change family restriction to anyone in the household.
Medicare (CARE)	Age, Work Disability, Social Security, Public Assistance or SSI, Veteran, Family Relationship	Public coverage occurs before private; un-imputed private coverage in public matrix.
Medicaid (CAID)	Age, Work Disability, Social Security, Public Assistance or SSI, Veteran, Family Relationship	Public coverage run before private; Un-imputed private coverage in public matrix.

Source: CPS ASEC Data Processing Specification

Table 2. Coverage Rates by Imputation Routine and Age, 2009 CPS ASEC

	Old			New			SHADAC-Enhanced			Difference					
										New - Old			New - Enhanced		
	Rate	SE	Count	Rate	SE	Count	Rate	SE	Count	Rate		Count	Rate		Count
All Ages															
Hierarchical Coverage															
Only Private	55.64	0.19	167,733	56.11	0.19	169,173	56.26	0.21	169,614	0.47	*	1,440	-0.15		-442
Any Public	28.99	0.15	87,411	29.02	0.15	87,478	28.91	0.18	87,168	0.03		67	0.11		310
Uninsured	15.37	0.13	46,340	14.87	0.13	44,832	14.83	0.14	44,700	-0.50	**	-1,507	0.04		132
Alone or in Combination															
Any Coverage	84.63	0.13	255,143	85.13	0.13	256,651	85.17	0.14	256,783	0.50	**	1,507	-0.04		-132
Any Private	66.67	0.21	200,992	67.21	0.21	202,629	66.81	0.20	201,432	0.54	*	1,637	0.40		1,197
Any Employment Based	58.49	0.21	176,332	58.89	0.22	177,543	58.67	0.21	176,880	0.40		1,212	0.22		664
Any Direct Purchase	8.88	0.10	26,777	9.46	0.11	28,514	8.42	0.11	25,394	0.58	***	1,738	1.04	***	3,120
Any Public	28.99	0.15	87,411	29.02	0.15	87,478	28.91	0.18	87,168	0.03		67	0.11		310
Any Medicare	14.27	0.06	43,029	14.27	0.06	43,031	14.26	0.13	42,998	0		2	0.01		33
Any Medicaid	14.14	0.13	42,641	14.17	0.13	42,722	14.07	0.15	42,408	0.03		81	0.10		314
Any Military Health Care	3.83	0.12	11,560	3.84	0.12	11,562	3.76	0.08	11,346	0.01		2	0.08		217
Under 19 Years															
Hierarchical Coverage															
Only Private	57.07	0.32	44,908	57.42	0.32	45,177	57.56	0.36	45,247	0.35		269	-0.14		-70
Any Public	32.66	0.33	25,699	32.64	0.33	25,686	32.91	0.35	25,874	-0.02		-13	-0.27		-188
Uninsured	10.26	0.19	8,076	9.94	0.19	7,820	9.53	0.21	7,492	-0.32		-256	0.41		328
Alone or in Combination															
Any Coverage	89.74	0.19	70,606	90.06	0.19	70,863	90.47	0.21	71,121	0.32		256	-0.41		-258
Any Private	63.58	0.31	50,029	63.75	0.31	50,158	63.00	0.36	49,525	0.17		129	0.75		633
Any Employment Based	58.68	0.30	46,173	58.75	0.30	46,227	58.18	0.36	45,738	0.07		54	0.57		489
Any Direct Purchase	5.12	0.16	4,025	5.83	0.17	4,588	4.65	0.15	3,658	0.71	***	563	1.18	***	930
Any Public	32.66	0.33	25,699	32.64	0.33	25,686	32.91	0.35	25,874	-0.02		-13	-0.27		-188
Any Medicare	0.84	0.07	664	0.84	0.07	664	0.82	0.07	645	0		0	0.02		19
Any Medicaid	29.70	0.31	23,368	29.69	0.31	23,362	30.01	0.34	23,596	-0.01		-7	-0.32		-234
Any Military Health Care	3.00	0.18	2,357	3.00	0.18	2,357	2.91	0.12	2,290	0		0	0.09		67

See footnotes at end of table

Table 2. Coverage Rates by Imputation Routine and Age, 2009 CPS ASEC - Continued

	Old			New			SHADAC-Enhanced			Difference: New - Old			Difference: New - Enhanced		
	Rate	SE	Count	Rate	SE	Count	Rate	SE	Count	Rate		Count	Rate		Count
19 to 64 Years															
Hierarchical Coverage															
Only Private	65.46	0.22	121,117	66.09	0.23	122,268	66.29	0.22	122,690	0.63	*	1,151	-0.20		-421
Any Public	14.20	0.15	26,278	14.25	0.15	26,359	13.95	0.15	25,821	0.05		80	0.30		538
Uninsured	20.33	0.17	37,617	19.67	0.17	36,386	19.76	0.18	36,571	-0.66	**	-1,231	-0.09		-185
Alone or in Combination															
Any Coverage	79.67	0.17	147,395	80.33	0.17	148,627	80.24	0.18	148,511	0.66	**	1,231	0.09		116
Any Private	69.55	0.21	128,676	70.27	0.22	130,001	70.00	0.21	129,553	0.72	**	1,325	0.27		449
Any Employment Based	63.21	0.23	116,946	63.81	0.23	118,058	63.70	0.22	117,898	0.60	*	1,112	0.11		160
Any Direct Purchase	6.84	0.10	12,648	7.39	0.10	13,677	6.38	0.11	11,807	0.55	***	1,029	1.01	***	1,870
Any Public	14.20	0.15	26,278	14.25	0.15	26,359	13.95	0.15	25,821	0.05		80	0.30		538
Any Medicare	3.82	0.08	7,061	3.82	0.08	7,063	3.78	0.08	6,994	0		2	0.04		69
Any Medicaid	8.56	0.12	15,845	8.61	0.12	15,927	8.34	0.12	15,444	0.05		83	0.27		484
Any Military Health Care	3.45	0.11	6,383	3.45	0.11	6,383	3.41	0.08	6,312	0		0	0.04		71
65 Years and Older															
Hierarchical Coverage															
Only Private	4.52	0.19	1,708	4.57	0.19	1,728	4.44	0.18	1,678	0.05		20	0.13		50
Any Public	93.77	0.21	35,434	93.77	0.21	35,434	93.87	0.21	35,473	0		0	-0.10		-39
Uninsured	1.71	0.10	646	1.66	0.10	627	1.69	0.11	637	-0.05		-20	-0.03		-11
Alone or in Combination															
Any Coverage	98.29	0.10	37,142	98.34	0.10	37,161	98.31	0.11	37,151	0.05		20	0.03		10
Any Private	58.98	0.54	22,287	59.46	0.53	22,470	59.16	0.48	22,354	0.48		182	0.30		116
Any Employment Based	34.96	0.51	13,212	35.09	0.53	13,258	35.05	0.48	13,244	0.13		46	0.04		14
Any Direct Purchase	26.74	0.49	10,103	27.12	0.48	10,249	26.28	0.44	9,929	0.38		146	0.84		320
Any Public	93.77	0.21	35,434	93.77	0.21	35,434	93.87	0.21	35,473	0		0	-0.10		-39
Any Medicare	93.43	0.21	35,304	93.43	0.21	35,304	93.57	0.22	35,360	0		0	-0.14		-56
Any Medicaid	9.07	0.25	3,428	9.07	0.25	3,428	8.92	0.26	3,369	0		0	0.15		59
Any Military Health Care	7.46	0.27	2,821	7.46	0.27	2,821	7.26	0.27	2,744	0		0	0.20		76

Source: SHADAC tabulations of the 2009 CPS ASEC Research File and the 2009 SHADAC-Enhanced CPS. Counts are presented in thousands. SE: Standard error, accounting for the complex sample design. Military Health Care includes Tricare and Department of Veterans Affairs (VA) coverage. *p<0.05; **p<0.01; ***p<0.001.

Table 3. Policy Holder/Dependent Coverage Rates by Imputation Routine and Age, 2009 CPS ASEC

	Old			New			SHADAC-Enhanced			Difference: New - Old			Difference: New - Enhanced		
	Rate	SE	Count	Rate	SE	Count	Rate	SE	Count	Rate		Count	Rate		Count
All Ages															
Policy Holder															
Private	36.31	0.12	109,473	36.36	0.12	109,612	36.26	0.14	109,306	0.05		139	0.10		306
Employment Based	30.86	0.13	93,052	30.85	0.13	92,994	30.83	0.13	92,959	-0.01		-58	0.02		35
Direct Purchase	6.55	0.07	19,752	6.71	0.08	20,215	6.28	0.08	18,923	0.16		462	0.43	***	1,291
Dependent															
Private	33.98	0.16	102,457	34.23	0.16	103,196	33.55	0.16	101,148	0.25		739	0.68	***	2,048
Employment Based	29.66	0.15	89,420	29.88	0.15	90,071	29.45	0.16	88,797	0.22		650	0.43	*	1,274
Direct Purchase	2.80	0.07	8,451	3.20	0.07	9,642	2.58	0.06	7,780	0.40	***	1,191	0.62	***	1,863
Under 19 Years															
Policy Holder															
Private	0.93	0.06	733	0.92	0.06	721	0.83	0.06	655	-0.01		-11	0.09		67
Employment Based	0.61	0.05	484	0.61	0.05	480	0.54	0.05	426	0		-3	0.07		54
Direct Purchase	0.33	0.03	256	0.32	0.03	248	0.30	0.03	234	-0.01		-8	0.02		15
Dependent															
Private	62.86	0.31	49,460	63.06	0.31	49,616	62.34	0.36	49,006	0.20		155	0.72		610
Employment Based	55.57	0.30	43,727	56.06	0.30	44,107	55.47	0.36	43,609	0.49		380	0.59		498
Direct Purchase	4.78	0.15	3,763	5.52	0.16	4,340	4.35	0.14	3,421	0.74	***	576	1.17	***	919
19 to 64 Years															
Policy Holder															
Private	48.71	0.17	90,112	48.76	0.17	90,210	48.67	0.18	90,087	0.05		98	0.09		123
Employment Based	44.62	0.17	82,552	44.59	0.17	82,496	44.63	0.18	82,594	-0.03		-56	-0.04		-98
Direct Purchase	5.37	0.08	9,941	5.57	0.08	10,306	5.03	0.09	9,309	0.20	*	365	0.54	***	996
Dependent															
Private	25.69	0.16	47,529	26.03	0.17	48,163	25.28	0.15	46,791	0.34		634	0.75	***	1,372
Employment Based	22.51	0.16	41,648	22.67	0.16	41,935	22.27	0.15	41,221	0.16		287	0.40	*	714
Direct Purchase	1.85	0.05	3,414	2.19	0.06	4,053	1.68	0.05	3,110	0.34	***	638	0.51	***	942

Source: SHADAC tabulations of the 2009 CPS ASEC Research File and the 2009 SHADAC-Enhanced CPS. Counts are presented in thousands. SE: Standard error, accounting for the complex sample design. Significant difference between imputation routines is indicated by confidence levels of: *p<0.05; **p<0.01; ***p<0.001.

Table 4. Demographic Characteristics by Full Supplement Status, 2009 CPS ASEC

	Total		Completed Supplements		Full Supplement Imputations		
	Percent	SE	Percent	SE	Percent		SE
Population (Count in Thousands)	301,482		272,865		28,617		
Hierarchical Coverage (New Routine)							
Only Private	56.1	0.19	56.5	0.20	52.7	***^	0.63
Any Public	29.0	0.15	29.0	0.16	29.0		0.54
Uninsured	14.9	0.13	14.5	0.14	18.3	***^	0.46
Hierarchical Coverage (Old Routine)							
Only Private	55.6	0.19	56.4	0.20	48.6	***	0.58
Any Public	29.0	0.15	29.0	0.16	28.8		0.54
Uninsured	15.4	0.13	14.6	0.14	22.6	***	0.49
Age							
0 to 14	20.4	0.01	20.8	0.03	16.4	***	0.31
15 to 24	13.9	0.01	13.6	0.03	16.4	***	0.32
25 to 34	13.4	0.01	13.3	0.04	14.5	**	0.36
35 to 44	13.7	0.01	13.6	0.03	14.4	**	0.29
45 to 64	26.1	0.01	26.0	0.04	26.6		0.40
65 and older	12.5	0.01	12.6	0.03	11.7	**	0.32
Relationship							
Reference person/spouse	45.9	0.15	46.1	0.16	44.8	**	0.40
Child/other relative	36.8	0.13	36.9	0.13	36.1		0.47
Unrelated	17.2	0.15	17.1	0.16	19.1	***	0.49
Marital Status							
Married	41.5	0.16	41.6	0.17	40.8		0.48
Never Married	44.3	0.11	44.2	0.12	45.0		0.45
Divorced/Separated	9.5	0.09	9.5	0.09	9.7		0.28
Widowed	4.7	0.06	4.8	0.06	4.5		0.19

See footnotes at end of table

Table 4. Demographic Characteristics by Full Supplement Status, 2009 CPS ASEC – Continued

	Total		Completed Supplements		Full Supplement Imputations		
	Percent	SE	Percent	SE	Percent		SE
Workers in Family (Past Year)							
0	16.0	0.13	16.0	0.14	15.7		0.45
1	38.4	0.21	38.3	0.23	39.1		0.65
2+	45.7	0.21	45.7	0.22	45.3		0.69
Self Employed	3.4	0.05	3.4	0.05	3.6		0.16
Work Limitation							
Working	52.6	0.11	52.4	0.11	54.6	***	0.45
Disabled	4.7	0.07	4.7	0.07	4.7		0.21
Other	42.7	0.10	42.9	0.10	40.7	***	0.47
Firm Size							
<=24 or not in universe	63.4	0.12	63.6	0.13	62.3	**	0.44
25 to 499	13.3	0.10	13.3	0.10	13.9	*	0.32
500 to 999	2.9	0.05	2.9	0.05	3.1		0.15
1000+	20.3	0.12	20.3	0.13	20.7		0.34
Social Security Beneficiary	14.3	0.07	14.3	0.08	13.5	*	0.35
Public Cash Transfer Recipient	2.4	0.05	2.3	0.05	2.7	*	0.15
Veteran (Active Duty not shown)	7.0	0.07	7.1	0.07	6.6	*	0.22
Sample Size	207,921 (100%)		188,965 (90.9%)		18,926 (9.1%)		

Source: SHADAC tabulations of the 2009 CPS ASEC Research File. All variables are specified in the same manner as in the hot deck, except for number of workers in the family which takes the place of work status of spouse. SE: Standard error, accounting for the complex sample design. Significant difference between full supplement imputations and completed supplements is indicated by confidence levels of: *p<0.05; **p<0.01; ***p<0.001. ^ Indicates that the difference in insurance rates across supplement status is significantly different in the new routine compared to the old routine at p <0.001.

Table 5. Multinomial Logit Regressions of Hierarchical Insurance Coverage on FSI and Covariates, 2009 CPS ASEC

	Model 1 (Old Routine – All Ages)						Model 2 (New Routine – All Ages)					
	Uninsured vs. Private			Public vs. Private			Uninsured vs. Private			Public vs. Private		
	RRR		SE	RRR		SE	RRR		SE	RRR		SE
Full Supplement Imputation (FSI)	1.77	***	0.062	1.33	***	0.059	1.29	***	0.049	1.23	***	0.055
Age												
0 to 14	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
15 to 24	3.12	***	0.101	0.58	***	0.017	2.97	***	0.099	0.56	***	0.017
25 to 34	5.34	***	0.234	0.33	***	0.016	4.90	***	0.221	0.31	***	0.015
35 to 44	3.81	***	0.191	0.20	***	0.011	3.52	***	0.186	0.19	***	0.010
45 to 64	2.50	***	0.127	0.15	***	0.008	2.33	***	0.123	0.14	***	0.008
65 and older	3.15	***	0.326	3.15	***	0.238	2.90	***	0.301	2.98	***	0.224
Relationship												
Reference person/spouse	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Child/other relative	1.98	***	0.077	1.23	***	0.052	1.89	***	0.071	1.18	***	0.048
Unrelated	0.84	***	0.035	0.38	***	0.016	0.86	***	0.035	0.37	***	0.016
Marital Status												
Married	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Never Married	1.55	***	0.065	0.90	*	0.043	1.49	***	0.062	0.89	*	0.043
Divorced/Separated	1.78	***	0.062	1.14	**	0.051	1.72	***	0.061	1.12	**	0.050
Widowed	1.97	***	0.134	1.77	***	0.113	1.86	***	0.135	1.73	***	0.112
Workers in Family (Past Year)												
0	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
1	0.27	***	0.012	0.22	***	0.009	0.28	***	0.012	0.22	***	0.010
2+	0.12	***	0.005	0.08	***	0.004	0.12	***	0.005	0.08	***	0.004
Self Employment												
Not self employed	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Self employed/unincorporated	1.58	***	0.069	1.49	***	0.086	1.58	***	0.070	1.49	***	0.087

See footnotes at end of table

Table 5. Multinomial Logit Regressions of Hierarchical Insurance Coverage on FSI and Covariates, 2009 CPS ASEC – Continued

	Model 1 (Old Routine – All Ages)						Model 2 (New Routine – All Ages)					
	Uninsured vs. Private			Public vs. Private			Uninsured vs. Private			Public vs. Private		
	RRR		SE	RRR		SE	RRR		SE	RRR		SE
Work Limitation												
Working	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Disabled	1.19	*	0.084	4.52	***	0.301	1.14		0.081	4.35	***	0.288
Other	0.46	***	0.013	0.84	***	0.037	0.46	***	0.013	0.84	***	0.036
Firm Size												
<=24 or not in universe	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
25 to 499	0.43	***	0.013	0.67	***	0.033	0.44	***	0.014	0.68	***	0.033
500 to 999	0.28	***	0.016	0.60	***	0.042	0.28	***	0.016	0.60	***	0.042
1000+	0.27	***	0.008	0.76	***	0.032	0.28	***	0.009	0.77	***	0.032
Social Security Beneficiary												
None	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Social Security	0.69	***	0.049	10.81	***	0.490	0.70	***	0.049	10.93	***	0.485
Public Cash Transfer Recipient												
None	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Public Assistance/SSI	1.73	*	0.363	140.32	***	19.979	2.08	***	0.414	153.81	***	22.079
Veteran Status												
Veteran	1.00		0.000	1.00		0.000	1.00		0.000	1.00		0.000
Not a Veteran/Active Duty	1.22	***	0.057	0.35	***	0.016	1.22	***	0.058	0.35	***	0.016
Intercept	0.47	***	0.040	11.93	***	1.044	0.50	***	0.044	12.35	***	1.092
Sample Size	207,921						207,921					
Model Diagnostics												
Adjusted Wald (FSI)	F = 132.77 (p <0.001)						F = 24.55 (p <0.001)					

Source: SHADAC analysis of the 2009 CPS ASEC Research File. RRR: Relative risk ratio. SE: Standard error, accounting for the complex sample design. Significant difference is indicated by confidence levels of: *p<0.05; **p<0.01; ***p<0.001.